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# The Solution Processed P(VDF-Trfe) Films For Energy Harvesting, Sensing, And Memory Applications

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Poly(vinylidene fluoride) (PVDF) and its copolymers with trifluoroethylene (TrFE) have been of great interests because they have excellent ferroelectric, piezoelectric, and pyroelectric properties, and are therefore the polymer of choice for a broad range of applications such as non-volatile memories, force sensors, pressure sensors, temperatures sensors, actuators, energy harvesters, and solid-state cooling devices. Herein, P(VDF-TrFE) copolymers are technically more important due to its superiority to the PVDF homopolymer in many aspects; the former have much better solution processibility, higher polarization, and no need of mechanical stretching. On the other hand, P(VDF-TrFE) comes with its own set of challenges, when they are used in the form of solid films as in above-mentioned applications. The first challenge is the severe electric shorting during the operation, and the second is the electrical break-down during poling process; the functionality of most P(VDF-TrFE) based electronic devices necessitates the electrical poling process. The problems on short circuits and the poling-induced break-down is much more severe in the solution-processed P(VDF-TrFE) films which are inherently more porous. In this work, the electric shorting in thick films (on the order of micrometers) and thin films (on the order of tens or hundreds of nanometers) is explicitly investigated. Many determining factors such as drying temperatures, solvent evaporation rates, and solution concentrations, were clearly identified. The detailed correlation of these determining factors with electric shorting condition is established for both thick films and thin films. The contact poling process was also studied to control the partial break-down and reduce the damaged area. The knowledge learned in the studies on short circuits and electrical poling was then applied to P(VDF-TrFE) film processing to successfully develop non-volatile memory devices, piezoelectric energy harvesters, and pulse sensors.

## Biography

Dr. Zhang has his expertise in organic electronics and passion in developing electronic devices for practical applications in everyday life. He started his research career with organic light-emitting electrochemical cells and OLEDs as a PhD student at Queen's University. Since his graduation in 2009, he has been working on organic solar cells and organic FETs. In recent years, he has extended his research area further to smart materials and devices with a focus on electroactive polymers.

**Notes:**